

## **Records of Enchytraeidae (Oligochaeta) from Western France and the Pyrénées**

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**Résumé.** — Deux séries de récoltes ont été effectuées dans cinq régions écologiquement différentes : Les Landes (Gironde et Landes), Libourne (Gironde), Pyrénées (Basses-Pyrénées et Espagne), La Grande Brière (Loire-Atlantique), et la Dordogne (Dordogne et Lot). Quatre-vingt-une stations ont été prospectées, la plupart appartenant à la zone terrestre. Soixante espèces sont déterminées dont trente-neuf sont nouvelles pour la France et quatorze sont nouvelles pour l'Espagne. La faune est semblable à celle des autres pays d'Europe mais quelques espèces qui sont fréquentes ailleurs manquent et deux sont caractéristiques de la région méridionale. Malgré la sécheresse qui prédominait pendant la première partie de l'étude, les vers étaient assez nombreux et la majorité étaient adultes. Il semble donc que les individus qui habitent des régions étudiées sont mieux adaptés à la chaleur et à la sécheresse que ceux des pays du nord de l'Europe.

**Abstract.** — Two surveys are described in which Enchytraeidae were collected in five ecologically distinct regions : Landes (Gironde and Landes), Libourne (Gironde), Pyrénées (Basses-Pyrénées and Spain), La Grande Brière (Loire-Atlantique) and Dordogne (Dordogne and Lot). Eighty-one sites were sampled, the majority representing terrestrial habitats. Sixty species are identified including thirty-nine which are new records for France and fourteen which are new for Spain. The fauna resembles that of other countries in western Europe but some species common elsewhere are absent and two "southern" species are recognised. In spite of high temperatures and drought during one of the survey periods, the worms were fairly plentiful in all but the driest soils and the majority were sexually mature. Individuals thus appear to be better adapted to a hot, dry climate than those occurring in northern Europe.

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### INTRODUCTION

Although the European Enchytraeidae are becoming quite well known due to a revival of interest in the family, the south-western part of the continent has, as yet, received little attention. The fauna of the Iberian Peninsula is practically unknown and while there are thirty-one published records for France, most are from aquatic habitats, the terrestrial species which are much more numerous having been largely ignored. Only ten species have been recorded from terrestrial habitats in France, all from the northeast (ČERNOSVITOV, 1931, 1936, 1941 ; MOSZYŃSKI, 1938 ; TÉTRY, 1938 ; NIELSEN and CHRISTENSEN, 1959). Freshwater enchytraeids are included in surveys of aquatic Oligochaeta by JUGET (1967), AMOROS and JUGET (1970), JUGET and GIANI (1974) and GIANI (1976) who between them record six species. Over two-thirds of French enchytraeid records are from marine

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habitats. Littoral species have been the subject of two surveys, one in the Bay of Arcachon (LASSERRE, 1966), the other in W. Brittany (LASSERRE, 1967). Further records, including Mediterranean localities, are listed by LASSERRE (1968, 1971) and by ERSÉUS and LASSERRE (1976).

This paper describes the results of two short surveys in western France and the Pyrénées in which particular attention was given to terrestrial habitats.

#### SAMPLING SITES

The two sampling periods were July 22nd-August 24th, 1975 and October 6-22, 1977. During the summer of 1975, western France, as indeed much of Europe, was suffering from severe drought and all soils in the regions investigated were exceptionally dry. It was not possible therefore to study the full range of soil types available. In some well-drained soils the fauna was greatly impoverished and the few specimens obtained were in poor condition. These soils were largely ignored and the selection of sites was biased in favour of habitats which are normally wet, e.g. marshes, heaths, ditches and river banks. The drier habitats were sampled during the second survey period when autumn rains had repaired the effects of summer drought.

Collections were made at eighty-one sites located in five ecologically distinct regions.

1. **Les Landes** (departments Gironde and Landes) : The most intensively studied region. The soils are young, consisting for the most part of well-sorted sands with varying amounts of organic matter. Low-lying areas are marshy due to the presence of an impervious sandstone bedrock (aïos) which impedes drainage. The soil reaction is acid except near the sea or roads or where flooding occurs.

2. **Libourne** (department Gironde) : One of the famous Bordeaux vineyard districts. The region is characterised by heavy alluvial clays with occasional limestone outcrops. The soil reaction is neutral or alkaline.

3. **Pyrénées** (altitude 160-1060 metres) (department Basses-Pyrénées and Spain). The principal rock is schist and the soils mainly leached loams. The lower slopes are dominated by forests of chestnut which give way to beech at about 700 metres. Except on steep slopes, the forest soils have a well developed litter layer and a mor humus formation. Soil reaction acid or neutral.

4. **La Grande Brière** (department Loire-Atlantique) : An extensive area of *Phragmites* fen. The soils consist of fen peats with small amounts of sand or gravel. At the time of sampling, the water table was low and many parts of the reedswamp had no surface water. The soils were somewhat acid, becoming very acid at drying surfaces but no acidophil plant species were observed.

5. **Dordogne** (departments Dordogne and Lot) : The region is characterised by limestone rock and poor sandy or clay soils. Except for fertile valleys, the soils are unsuitable for conventional forms of agriculture. About one-third of the land surface is forest, mainly chestnut with some beech and oak.

TABLE 1. — Sampling sites  
(Soil moisture and pH indications in brackets refer to the second sampling date.)

SITE No.	LOCALITY AND DEPARTMENT	SAMPLING DATE	VEGETATION	SOIL
<b>Les Landes</b>				
1	Pilat Plage (33)	23.vii.75 6.x.77	Coastal <i>Pinus</i> forest.	Sandy, loose structure. Dry. pH 6.3.
2	Arcachon (33)	25.vii.75	<i>Quercus</i> forest.	Sandy, mor humus over sand. Dry. pH 4.6-4.8.
3	Facture (33)	26.vii.75	Mixed <i>Quercus-Pinus</i> forest.	Sandy, mor humus over sand. Moist-dry. pH 4.5-4.6.
4	La Teste (33)	6.viii.75	<i>Quercus</i> forest with some <i>Pinus</i> .	Sandy, mor humus over sand. Moist-dry. pH 4.7-4.9.
5	Arcachon (33)	8.viii.75	Mixed stand of <i>Robinia pseudacacia</i> and <i>Tamarix</i> on coast.	Sandy, rich in organic matter. Moist. pH 6.4-6.6.
6	La Teste (33)	6.viii.75	<i>Alnus</i> swamp.	Humified peat with a little sand. Wet. pH 4.6-4.9.
7	Facture (33)	26.vii.75 19.x.77	<i>Alnus</i> swamp.	Peaty silt with pockets of sand. Moist-wet (very wet). pH 5.4 (5.2).
8	Arcachon (33)	23.vii.75	Marshy scrub with <i>Salix</i> and <i>Populus</i> .	Sandy peat. Moist. pH 6.4-7.0.
9	Facture (33)	22.vii.75 19.x.77	Wet heath with <i>Erica</i> , <i>Drosera</i> and <i>Sphagnum</i> .	Coarse, sandy peat. Moist-wet. pH 3.9-4.3 (4.3).
10	Cazaux (33)	13.viii.75	Wet heath with <i>Schoenus</i> , <i>Drosera</i> and some <i>Sphagnum</i> .	Sandy peat over wet sand. Wet. pH 5.0.
11	La Teste (33)	7.viii.75 19.x.77	Old meadow.	Dark brown, sandy. Open texture. Dry (moist). pH 7.9.
12	La Teste (33)	6.viii.75 19.x.77	Low-lying pasture.	Brown, sandy. Moist. pH 7.8-8.1.
13	Arcachon (33)	12.viii.75 20.x.77	Garden lawn. Artificially watered.	Dark brown, sandy. Moist. pH 7.9 (6.9).

SITE No.	LOCALITY AND DEPARTMENT	SAMPLING DATE	VEGETATION	SOIL
14	Arcachon (33)	12.viii.75	Roadside lawn. Artificially watered.	Dark brown, sandy. Moist.
15	La Teste (33)	6.viii.75 22.x.77	Marshy pasture. <i>Juncus</i> 20 %.	Sandy. Loose structure. Dry (moist-wet). pH 5.9 (5.2).
16	La Teste (33)	6.viii.75 22.x.77	Marshy pasture. <i>Carex</i> 50 %, <i>Juncus</i> 30 %.	Sandy peat. Moist (wet). pH 5.2-5.3. pH 4.5.
17	La Teste (33)	9.viii.75 22.x.77	Marshy pasture. <i>Juncus</i> 70 %.	Dark humified peat with a little sand. Moist-wet (very wet). pH 5.5-5.6 (5.2).
18	Arcachon (33)	24.vii.75 22.x.77	Marshy pasture. <i>Carex</i> dominant with some <i>Phragmites</i> .	Sandy. Moist (moist-wet). pH 5.8-5.9.
19	Arcachon (33)	24.vii.75	<i>Phragmites</i> reedswamp on coast.	Sandy peat. Moist. pH 5.2-5.6.
20	Cazaux (33)	13.viii.75	<i>Phragmites</i> reedswamp at lakeside.	Sandy peat. Moist-wet.
21	Cazaux (33)	13.viii.75	Marsh at lakeside.	Coarse, spongy peat with pockets of sand. Wet. pH 4.9-6.2
22	Petit Nice (33)	21.viii.75 20.x.77	Supralittoral. Dune slack, <i>Juncus</i> dominant.	Peaty sand. Wet. pH 6.2.
23	Petit Nice (33)	21.viii.75	Supralittoral. Mobile dunes. No vegetation.	Sand. Moist after rain.
24	Petit Nice (33)	21.viii.75	Supralittoral. Fixed dunes. Early stage of colonisation by <i>Pinus</i> .	Sand with 1 cm <i>Pinus</i> litter.
25	Cap-Ferret (33)	28.vii.75	Supralittoral. Mobile dunes. 25 % plant cover.	Sand, moist. (Sample taken at 20 cm.)
26	Cap-Ferret (33)	21.vii.75	As No. 25 but older. 40 % plant cover.	Sand, moist. (Sample taken at 20 cm.)
27	Arcachon (33)	8.viii.75	Salt-marsh, upper edge. <i>Agropyron</i> and <i>Tamarix</i> .	Sandy. Moist.
28	Arcachon (33)	8.viii.75	Salt-marsh. <i>Juncus</i> zone.	Peaty mud. Wet.
29	Arcachon (33)	8.viii.75 18.x.77	Salt-marsh. <i>Halimione-Aster</i> zone.	Mud. Wet.
30	Arcachon (33)	18.x.77	<i>Quercus</i> forest.	Mor humus and litter. Moist. pH 4.3.
31	Arcachon (33)	19.x.77	<i>Pinus</i> forest.	Mor humus with sand. Dry. pH 3.9.

SITE No.	LOCALITY AND DEPARTMENT	SAMPLING DATE	VEGETATION	SOIL
32	Faeture (33)	21.x.77	<i>Alnus</i> scrub with <i>Drosera</i> .	Dark, humified, sandy peat. Wet.
33	Sanguinet (40)	22.x.77	Young <i>Pinus</i> plantation.	Coarse, sandy peat. Wet. pH 4.0.
34	Le Corneau, near Areaehon (33)	22.x.77	Wet heath.	Sandy peat and peaty sand. Wet. pH 4.0-5.7.
35	Cazaux aerodrome (33)	21.x.77	Wet heath, with <i>Sphagnum</i> and <i>Erica</i> spp.	Peat. Moist-wet. pH 3.6
36	Lae de Cazaux at Sanguinet (40)	21.x.77	Marsh at lakeside.	Peat. Moist-wet. pH 5.8.
37	Petit Nice (33)	20.x.77	Dune slaek with <i>Phragmites</i> .	Sand with coarse plant remains. Moist.
38	Petit Nice (33)	20.x.77	Dune edge near high water.	Sand with coarse plant remains. Freshwater seepage.
39	Messanges (40)	12.x.77	Dune slaek with <i>Thymus</i> .	Sand with finely divided humus. Moist.
40	Le Corneau, near Areaehon (33)	22.x.77	<i>Pinus</i> forest.	Sandy humus with litter. Dry-moist. pH 3.8
41	Lac d'Hossegor (40)	11.x.77	<i>Phragmites</i> reedswamp at edge of braekish lagoon.	Sand. Very wet, partly submerged.
<b>Libourne</b>				
42	Fronsac (33)	10.viii.75	Mixed wood on hillside with <i>Ulmus</i> , <i>Crataegus</i> , <i>Populus</i> .	Clay with mull humus. Open texture. Dry (moist). pH 7.4-8.1 .
43	River Isle, Fronsac (33)	10.viii.75	Woodland strip beside river. <i>Ulmus</i> , <i>Corylus</i> , <i>Prunus</i> and <i>Hedera</i> .	Clay. Open texture. Dry. pH 7.9-8.2.
44	River Dordogne, Fronsac (33)	10.viii.75	Woodland strip beside river. <i>Ulmus</i> , <i>Fraxinus</i> and <i>Alnus</i> .	Clay-loam, open texture. Moist. pH 8.0-8.2.
45	Fronsac (33)	10.viii.75 7.x.77	Meadow (harvested). 50 % <i>Trifolium</i> .	Soft elay, gley mottling. Moist. pH 7.9-8.0 (7.4).
46	Libourne (33)	10.viii.75 7.x.77	Meadow (harvested).	Clay. Dry-moist. pH 8.0-8.2 (7.2).
47	River Dordogne, Fronsac (33)	10.viii.75	Marsh on floodbank of river.	Alluvial elay. Moist. pH 8.0.

SITE No.	LOCALITY AND DEPARTMENT	SAMPLING DATE	VEGETATION	SOIL
48	River Isle, Fronsae (33)	10.viii.75	Floodbank of river.	Alluvial clay. Wet. pH 7.7.
49	Libourne (33)	10.viii.75	Bank of ditch.	Clay. Wet. pH 7.5-7.8.
<b>Pyénées</b>				
50	Roneesvalles (Spain)	31.vii.75	<i>Fagus</i> forest.	5-8 cm litter and mor humus over loam. Moist. pH 4.5-4.8.
51	Roneesvalles (Spain)	31.vii.75	Small stream in <i>Fagus</i> forest.	Accumulation of unhumified <i>Fagus</i> litter and silt. pH 6.8-7.2.
52	Alto Ibañeta (Spain)	31.vii.75	Young plantation of <i>Larix</i> and <i>Picea</i> .	1-2 cm litter over clay-loam. Moist. pH 4.4-4.8.
53	Roncesvalles (Spain)	31.vii.75	Marshy pasture. <i>Juncus</i> 25 %.	Clay-loam. Moist. pH 5.6-6.1.
54	Roneesvalles (Spain)	31.vii.75 9.x.77	Marshy pasture. <i>Carex</i> 30 %, <i>Juncus</i> 10 %.	Sandy loam. Gley mottling. Moist (very wet). pH 6.0-6.1 (5.5-6.0).
55	Roneesvalles (Spain)	31.vii.75	Flushed area in pasture.	Coarse, sandy peat. Very wet (partly flooded). pH 7.2.
56	Saint-Jean-Pied-de-Port (64)	1.viii.75	River bank with liverworts.	Alluvial silt and leaf litter. Very wet. pH 7.5.
57	Roncesvalles (Spain)	9.x.77	Mountain pasture beside stream.	Sandy loam. Moist-wet. pH 4.8.
58	Estérençuby (64)	9.x.77	<i>Castanea</i> forest near mountain summit.	Clay-loam. Very little litter. Moist-dry. pH 4.0.
59	Estérençuby (64)	9.x.77	<i>Calluna-Ulex</i> heath on mountain side.	Clay-loam with a little litter. Moist. pH 5.7.
60	Fuenterrabía (Spain)	10.x.77	Intertidal. Red algal turf on rocks at HWN.	Muddy sand trapped in algal turf.
61	Hendaye (64)	11.x.77	Intertidal. <i>Corallina</i> turf.	Muddy sand trapped in algal turf.
62	Hendaye (64)	11.x.77	<i>Enteromorpha</i> in freshwater trickle on cliff above HW.	Muddy sand trapped in algae.

SITE No.	LOCALITY AND DEPARTMENT	SAMPLING DATE	VEGETATION	SOIL
63	Hendaye (64)	11.x.77	Intertidal. <i>Enteromorpha</i> mat near sewage outlet.	Black mud with shell debris.
64	Hendaye (64)	11.x.77	Dune edge at top of beach above HW. Grass.	Sand. Very little organic matter.
<b>La Grande Brière</b>				
65	Fédrun (44)	16.viii.75	<i>Salix</i> scrub.	Humified peat and sand. Dry. pH 5.2-6.1.
66	Fédrun (44)	16.viii.75	Edge of canal.	Dark, partly humified peat with a little gravel. Wet. pH 5.7.
67	Saint-Joachim (44)	16.viii.75	Dried pool in <i>Phragmites</i> reedswamp.	Dark, humified peat with a little sand. Wet. pH 3.1-3.3.
68	Saint-Joachim (44)	16.viii.75	<i>Phragmites</i> reedswamp.	<i>Phragmites</i> litter and partly humified peat. Moist. pH 5.6.
69	Fédrun (44)	16.viii.75	<i>Phragmites</i> reedswamp.	<i>Phragmites</i> litter and partly humified peat. Moist. pH 3.2-4.5.
<b>Dordogne</b>				
70	Sainte-Marie-de-Chignac (24)	15.x.77	Mixed wood on hillside. <i>Quercus</i> , <i>Juniperus</i> , <i>Pinus</i> .	Clay loam with mull humus. Moist. pH 7.2.
71	Sainte-Marie-de-Chignac (24)	15.x.77	Marshy grassland, <i>Juncus</i> 60 %.	Black, humified, muddy peat. Wet. pH 6.5.
72	Saint-Céré (46)	16.x.77	<i>Castanea</i> forest on hillside.	Litter and mor humus. Moist. pH 4.5.
73	Saint-Céré (46)	16.x.77	Pasture.	Loam. Moist. pH 5.8.
74	Leyme (46)	16.x.77	<i>Fagus</i> forest.	Litter and mor humus. Moist. pH 4.0.
75	Leyme (46)	16.x.77	Marsh in hillside pasture.	Sandy peat. Very wet, poached. pH 5.0.
76	Padirac (46)	16.x.77	<i>Fagus</i> forest.	Litter and mor humus. Moist. pH 6.2-6.9.
77	Saint-Cernin-de-Larche (19)	16.x.77	Pasture.	Loam. Moist. pH 7.0.
78	8 km E of Puy-l'Évêque (46)	16.x.77	Rough grass at edge of field under <i>Populus</i> .	Sandy loam, high organic content. Rather dry. pH 7.3.
79	Figeac (46)	16.x.77	<i>Quercus</i> scrub.	Pink clay with limestone fragments. Moist. pH 6.0.
80	Lacapelle (46)	16.x.77	<i>Picea</i> plantation.	2 cm litter over loam. Dry. pH 3.4.
81	River Dordogne at Guges (46)	16.x.77	<i>Fontinalis</i> mat on floodbank.	Sandy mud. Wet. Subject to periodic flooding. pH 5.8.

TABLE 2. — Regional distribution of the species  
(marine intertidal sites omitted).

SPECIES	Landes	Libourne	Pyrénées	Brière	Dordogne	% of sites
Number of sites	37	8	11	5	12	81
<i>Mesenchytraeus armatus</i>	—	—	—	—	1	1.2
<i>M. beumeri</i>	2	—	—	—	1	3.6
<i>M. gaudens</i>	2	—	—	—	—	2.5
<i>M. glandulosus</i>	2	—	—	—	—	2.5
<i>M. sanguineus</i>	4	—	2	—	—	7.4
<i>Cernosvitoviella atrata</i>	4	—	2	—	—	7.4
<i>C. goodhui</i>	3	—	—	—	2	6.2
<i>C. palustris</i>	—	—	1	—	1	2.5
<i>Cognettia cognettii</i>	—	—	3	—	2	6.2
<i>C. glandulosa</i>	11	—	4	2	2	23.4
<i>C. hibernica</i>	—	—	—	—	1	1.2
<i>C. sphagnetorum</i>	22	—	6	—	3	38.0
<i>Hemienchytraeus bifurcatus</i>	4	—	—	3	—	8.6
<i>Achaeta aberrans</i>	1	—	—	—	—	2.5
<i>A. affinis</i> agg.	4	—	3	—	—	18.5
<i>A. bohémica</i>	—	1	1	—	—	2.5
<i>A. eiseni</i> agg.	6	3	4	—	2	18.5
<i>A. littoralis</i>	1	—	—	—	—	1.2
<i>A. vesiculata</i>	—	—	—	—	1	1.2
<i>Enchytronia parva</i>	1	—	—	—	—	1.2
? <i>Enchytronia</i> sp.	4	—	—	—	2	7.4
<i>Guaranidrilus europeus</i>	2	—	2	—	—	4.9
<i>Henlea perpusilla</i>	2	3	1	—	3	11.1
<i>H. similis</i>	—	1	—	—	1	2.5
<i>H. ventriculosa</i>	5	1	—	3	—	11.1
<i>Buchholzia fallax</i>	9	5	2	—	6	27.0
<i>Hemifridericia parva</i>	2	—	—	—	—	2.5
<i>Fridericia aurita</i>	—	2	—	—	1	3.6
<i>F. bisetosa</i>	5	3	1	—	—	11.1
<i>F. bulboides</i>	5	3	2	5	3	22.2
<i>F. bulbosa</i>	10	3	—	—	3	19.7
<i>F. callosa</i>	4	—	—	—	—	4.9
<i>F. caprensis</i>	—	1	—	—	—	1.2
<i>F. connata</i>	—	—	3	—	3	7.4
<i>F. discifera</i>	—	1	—	—	—	1.2
<i>F. galba</i>	1	1	—	—	1	3.6
<i>F. leydigi</i>	2	—	—	—	1	3.6
<i>F. magna</i>	—	—	2	—	—	2.5
<i>F. paroniana</i>	7	3	1	—	1	14.8
<i>F. perrieri</i>	3	3	3	—	2	13.6
<i>F. polychaeta</i>	3	—	—	—	—	3.6



SPECIES	Landes	Libourne	Pyénées	Brière	Dordogne	% of sites
Number of sites	37	8	11	5	12	81
<i>F. ratzeli</i>	2	—	—	—	1	3.6
<i>F. stephensoni</i>	1	—	—	—	—	1.2
<i>F. striata</i>	2	—	—	—	1	3.6
<i>Enchytraeus albidus</i>	1	—	—	—	—	1.2
<i>E. buchholzi</i>	5	3	—	3	—	13.6
<i>E. capitatus</i>	5	—	1	—	—	7.4
<i>E. minutus</i>	10	4	4	3	6	33.2
<i>Marionina achaeta</i>	2	—	—	—	—	4.9
<i>M. argentea</i>	10	6	6	—	5	33.2
<i>M. clavata</i>	6	—	1	—	—	8.6
<i>M. filiformis</i>	6	—	—	—	—	7.4
<i>M. riparia</i>	—	1	—	—	—	1.2
<i>M. simillina</i>	—	—	1	—	—	1.2
<i>M. southerni</i>	2	—	—	—	—	2.5
<i>M. spicula</i>	2	—	—	—	—	2.5
<i>M. subterranea</i>	2	—	—	—	—	2.5
(TOTAL : 57)	43	19	23	6	26	

The Landes, Libourne and Pyénées regions were sampled during both survey periods and some sites were sampled twice. Sites in La Grande Brière and Dordogne were only sampled once. Brief descriptions of the sites are given in table 1.

#### METHODS

At each site, two samples were taken, each 300-500 cc in volume. Except where otherwise stated (table 1) all samples were taken from the top 10 cm. Worms were extracted from the samples using the wet funnel method (O'CONNOR, 1955) and identifications were made on live material. Appearance and consistancy at the time of sampling were used to make a subjective estimate of the soil water content and the soils were then classed as very wet, wet, moist or dry. pH measurements were made at most sites using a 1 : 1 soil-water mixture.

#### RESULTS

A total of sixty species were identified including thirty-nine which are new to France and one (*Guaranidrilus europeus*) which is new to science (HEALY, *in press*). Fourteen

species are new to Spain. The regional distribution of non-marine species is shown in table 2. Previous records are given in table 3.

Among the new records are several which were previously recorded from restricted areas in Europe, e. g. *Achaeta vesiculata* and *Marionina simillina* (Denmark), *Cernostoviella goodhui*, *C. palustris* and *Cognettia hibernica* (Ireland) and *Fridericia stephensoni* (Poland). These finds are important not only for their contribution to our knowledge of the species distribution and ecology but also as confirmation of their taxonomic status.

The relatively poor representation of *Achaeta* spp. (table 2) is due to the fact that a large proportion of individuals could not be identified owing to deficiencies in literature. The genus is in fact very common in all regions except in Brière. Similarly, many mature *Fridericia* could not be assigned definitively to any known species.

#### NOTES ON THE TAXONOMY, ECOLOGY AND DISTRIBUTION OF THE SPECIES

Where the species is present in large numbers, the site number is printed in bold-faced types.

*Mesenchytraeus armatus* (Levinsen, 1884).

One mature and several immature specimens in very wet pasture.

SITE : Dordogne, 75.

*Mesenchytraeus beumeri* (Michaelsen, 1888).

In moist-wet, acid soils. Always in low numbers.

SITES : Landes, 1, 34 ; Dordogne, 75.

*Mesenchytraeus gaudens* Cognetti, 1903.

One adult, 62 segments, blood slightly red ; several immature specimens with colourless blood.

SITES : Landes, 33, 35.

*Mesenchytraeus glandulosus* (Levinsen, 1884).

In deep humus under beech and chestnut.

SITES : Dordogne, 72, 74.

*Mesenchytraeus sanguineus* Nielsen and Christensen, 1959.

Adults have 4-7 preclitellar setae. In wet peat or very wet, acid soils, pH 3.9-7.2.

SITES : Landes, 9, 10, 32, 33 ; Pyrénées, 51, 54.

*Cernostoviella atrata* (Bretscher, 1903).

Spermatheca confined to V in all mature specimens examined. Numbers rather low by comparison with equivalent Irish habitats. Mature individuals formed a high proportion of the populations in 1977 but were rare in 1975.

SITES : Landes, 9, 10, 12, 21 ; Pyrénées, 51, 54.

*Cernosvitoviella goodhui* Healy, 1975.

The species is closely related to *C. aggtelekiensis* Dosza-Farkas from which it differs only in the origin of the dorsal vessel, shape of the spermatheca and proportions of the sperm duct. In wet soils.

SITES : Landes, 16, 32, 34 ; Dordogne, 75, 81.

*Cernosvitoviella palustris* Healy, *in press.*

26-28 segments. Two finds in very wet, marshy soil.

SITES : Pyrénées, 54 ; Dordogne, 75.

*Cognettia cognettii* (Issel, 1905).

In forest humus and acid soils which are not too wet.

SITES : Pyrénées, 50, 52, 58 ; Dordogne, **74**, 76.

*Cognettia glandulosa* (Michaelsen, 1888).

Mainly in marshy pastures. Dense populations occur in very wet soils. No mature specimens found.

SITES : Landes, 3, 6, 8, **11**, 12, 16, 18, **19**, 21, 32, 35 ; Pyrénées, 51, 53, **54**, 55 ; Brière, 66, 68 ; Dordogne, 75, **81**.

*Cognettia hibernica* Healy, 1975.

Five specimens in a very wet, marshy pasture. Characters agree closely with Irish material except for segment number which is 29-34 compared with 23-28 in Ireland.

SITE : Dordogne, 75.

*Cognettia sphagnetorum* (Vejdovsky, 1877).

The most frequently occurring enchytraeid species. Common and widespread in acid habitats, absent from fertile grasslands and calcareous soils. One mature specimen (6.viii.75).

SITES : Landes, 2, 3, 4, **6**, 7, **9**, 10, **11**, 12, 16, 17, 18, 20, 21, 30, 31, 32, 33, 34, **35**, 36, 40 ; Pyrénées, 50, **52**, 53, 54, 55, 56 ; Dordogne, 72, 74, 80.

*Hemienchytraeus bifurcatus* Nielsen and Christensen, 1959.

In wet heath and marsh.

SITES : Landes, 10, 17, 21, 34 ; Brière, 65, 66, **68**.

*Achaeta aberrans* Nielsen and Christensen, 1961.

One mature and several immature specimens in wet heath. The small size and lateral setal sacs make this species unmistakable but French specimens differ from Danish and Irish in having a stouter sperm funnel, up to two thirds body width.

SITE : Landes, 34.

*Achaeta affinis* agg.

All athecate individuals are included although it seems likely that two species may be involved, one of which is probably *A. affinis* Nielsen and Christensen, 1959.

SITES : Landes, 2, 3, 4, 18 ; Pyrénées, 50, 52, 56.

*Achaeta bohémica* (Vejdovsky, 1879) sensu NIELSEN and CHRISTENSEN, 1959.

Two finds in dry woodland soil and mountain pasture.

SITES : Landes, 44 ; Pyrénées, 57.

*Achaeta eiseni* agg.

Included here are all individuals with ventral sacs 2-4 times the thickness of the body wall, three pairs of septal glands, dorsal vessel originating in VII and spermatheca with oblique ectal portion covered in small glands. There is however wide variation in the size of the sperm funnel, seminal vesicle and spermathecal ampulla. It is believed that at least two species are involved, one of which may be *A. eiseni* Vejdovsky, 1887.

SITES : Landes, 3, 7, 8, 11, 12, 15 ; Libourne, 42, 44, 48 ; Pyrénées, 50, 52, 53, 54 ; Dordogne, 74, 79.

*Achaeta littoralis* Lasserre, 1968.

Several specimens in wet sand near high water mark.

SITE : Landes, 38.

*Achaeta vesiculata* Nielsen and Christensen, 1959.

One mature individual in old grassland. The only departure from the original description is shown by the sperm funnel which is 5 times longer than wide i. e. 1.5 times body width.

SITE : Dordogne, 78.

*Enchytronia parva* Nielsen and Christensen, 1959.

Typical forms were only found at one site in sand dune where it was fairly common. Mature individuals had 26-27 segments.

SITE : Landes, 39.

? *Enchytronia* sp.

Specimens resembling the typical *E. parva* but differing by the absence of intestinal diverticula were found at 7 sites. Size, segment number, setal arrangement, septal glands and form of the spermatheca are as in *E. parva* but a swelling on the dorsal surface of the intestine in VI replaces the diverticula, the sperm funnel is only about half the body width instead of 1-2 times and there are usually 2 ectal glands at the spermathecal opening. This is undoubtedly a separate species which requires further study.

In pine forest, oak scrub and grassland.

SITES : Landes, 1, 11, 33, 40 ; Dordogne, 73, 79.

*Guaranidrilus europeus* Healy, *in press*.

This is the first record of *Guaranidrilus* outside tropical parts of South America and Africa.

Nine specimens were taken from two sites in wet, marshy pasture at Roncesvalles in 1975 but none could be found at this locality in 1977. Another population near Arca-chon yielded twenty-one specimens.

SITES : Landes, 12, 34 (type locality) ; Pyrénées, 54, 55.

TYPE MATERIAL : Holotype (microslide) British Museum (Natural History) ; paratypes, Muséum national d'Histoire naturelle, Paris.

*Henlea perpusilla* Friend, 1911 augm. CERNOSVITOV, 1937.

In moist or wet mineral soils.

SITES : Landes, 12, 16 ; Libourne, 45, **46**, 47 ; Pyrénées, 51 ; Dordogne, **73**, 79, 81.

*Henlea similis* Nielsen and Christensen, 1959.

Two specimens in rough grass under *Populus alba* and two in deciduous wood.

SITES : Libourne, 42 ; Dordogne, 78.

*Henlea ventriculosa* (Udekem, 1854).

In moist soils.

SITES : Landes, 12, 13, 15, 16, 18 ; Libourne, 47 ; Brière, 65, 66, 68.

*Buchholzia fallax* Michaelsen, 1887.

A common and widely distributed species with a broad ecological range. Particularly frequent in woodland.

SITES : Landes, 1, 2, 12, 13, 14, 16, 18, 30, 32 ; Libourne, **42**, 45, 46, **47**, **48** ; Pyrénées, 51, 59 ; Dordogne, **70**, 71, 74, **76**, 78, 79.

*Hemifridericia parva* Nielsen and Christensen, 1959.

Plentiful in a garden lawn ; a few specimens in pine forest.

SITE : Landes, 1, 13.

*Fridericia aurita* Issel, 1905.

Three finds, all in clay soil on limestone.

SITES : Libourne, 43, 49 ; Dordogne, 79.

*Fridericia bisetosa* (Levinsen, 1884).

The species is sometimes difficult to distinguish from other bisetose species and may be more widespread than indicated by the records quoted. Occasionally 4 setae in some ventral bundles. In a variety of soil types.

SITES : Landes, 4, 12, 17, 30, 32 ; Libourne, 46, 47, 49 ; Pyrénées, 57.

*Fridericia bulboides* Nielsen and Christensen, 1959.

In a variety of soil types.

SITES : Landes, 1, 11, 12, 16, 18 ; Libourne, 43, 45, 47 ; Pyrénées, 53, 54 ; Brière, 65, 66, 67, 68, 69 ; Dordogne, 71, 73, 75.

*Fridericia bulbosa* (Rosa, 1887).

In a wide range of habitats.

SITES : Landes, 1, 5, 6, 11, 13, 15, 16, 18, 39, 40 ; Libourne, 43, 45, 48 ; Dordogne, 73, 79.

*Fridericia callosa* (Eisen, 1878).

Characteristic of habitats in the supralittoral zone.

SITES : Landes, 18, 22, 27, 37.

*Fridericia caprensis* Bell, 1947.

Differs from the description given by NIELSEN and CHRISTENSEN (1963) only in the smaller number of setae which is 4-2,4 : 4-2,4.

SITE : Libourne, 45.

*Fridericia connata* Bretscher, 1902.

In moist and wet grassland.

SITES : Pyrénées, 53, 56, 57 ; Dordogne, 71, 73, 77.

*Fridericia discifera* Healy, 1975.

Three specimens in moist woodland.

SITE : Libourne, 43.

*Fridericia galba* (Hoffmeister, 1843).

Low numbers at three sites in rough grassland.

SITES : Landes, 11 ; Libourne, 45 ; Dordogne, 77.

*Fridericia leydigi* (Vejdovsky, 1877).

In grassland.

SITES : Landes, 13, 16 ; Dordogne, 77.

*Fridericia magna* Friend, 1899.

Two finds in rather dry soil.

SITES : Pyrénées, 58, 59.

*Fridericia paroniana* Issel, 1904.

Although many bisetose specimens possessing two spermathecal diverticula and falling within the size range of *F. paroniana* have been found, many showed peculiarities of the

spermatheca and have been ignored. There may be several ill-defined species or *F. paroniana* may be more variable than previously supposed.

SITES : Landes, 4, 5, 7, 11, 12, 13, 40 ; Libourne, 42, 45, 46 ; Pyrénées, 54 ; Dordogne, 74.

*Fridericia perrieri* (Vejdovsky, 1977).

Mainly in moist-wet, mineral soils, especially marshy pastures.

SITES : Landes, 7, 16, 18 ; Libourne, 43, 46, 48 ; Pyrénées, 51, 53, 54 ; Dordogne, 71, 72.

*Fridericia polychaeta* Bretscher, 1900 : SOUTHERN, 1907.

Although this species was considered doubtful by NIELSEN and CHRISTENSEN (1959) due to inadequacies of the original description, SOUTHERN's description of Irish specimens which he identified as *F. polychaeta* (Southern, 1907) has been found to fit material from a number of other Irish localities (HEALY, 1978). French specimens also fit this description.

In marshy pastures.

SITES : Landes, 12, 16, 18.

*Fridericia ratzeli* (Eisen, 1872).

The 2 mature specimens found had 70-71 segments but only 4 preclitellar setae.

SITES : Landes, 5, 19 ; Dordogne, 72.

*Fridericia stephensoni* Moszyński, 1933.

Although this species was considered valid by NIELSEN and CHRISTENSEN (1959) it has not been found since 1933 when MOSZYŃSKI described it from specimens collected in Poland. Abundant material from site 16 allows the extent of variation within a population to be assessed. The species is conspicuous by its large size (living specimens up to 40 mm, segments 76-88) and a brown colouration of the last segment. These characters, together with setal number and the spermatheca which is large with usually two, nearly sessile ampullae, are sufficient to characterise the species. French material differs from Polish however in that the peptonophridia are branched at the ends and not simple as stated by MOSZYŃSKI. A seminal vesicle is present and there is a small gland at the ectal opening of the spermatheca, both absent in Polish specimens. These are features known to vary in other *Fridericia* species. Among approximately 20 specimens examined, one had 3 ampullae on one side while another had 3 on one side and 4 on the other. This variation is reminiscent of *F. galba* but the ampullae are stalked in this species.

SITE : Landes, 16.

*Fridericia striata* (Levinson, 1884).

Two specimens in oakwoods and two in a beechwood.

SITES : Landes, 2, 30 ; Dordogne, 76.

*Enchytraeus albidus* Henle, 1837.

In salt marsh and wet sand near high water mark.

SITES : Landes, 27, 28, 38.

*Enchytraeus buchholzi* Vejdovsky, 1879.

In a variety of soil types.

SITES : Landes, 13, 14, 16, 22, 37 ; Libourne, 45, 47, 48 ; Brière, 65, 66, 68.

*Enchytraeus capitatus* v. Bülow, 1957.

In sand dunes, sand near high water mark and intertidal mud.

SITES : Landes, 23, 24, 25, 26, 38 ; Pyrénées, 63, 64.

*Enchytraeus minutus* Nielsen and Christensen, 1961.

A common and widespread species with a wide ecological range. Individuals had up to 31 segments ; a seminal vesicle was usually absent.

SITES : Landes, 5, 7, 8, 13, 16, 17, 18, 31, 32, 34 ; Libourne, 45, 46, 47, 49 ; Brière, 66, 68, 69 ; Pyrénées, 51, 53, 54, 55 ; Dordogne, 70, 71, 76, 77, 78, 81.

*Lumbricillus kaloensis* Nielsen and Christensen, 1959.

Two specimens from the edge of a brackish lagoon.

SITE : Landes, 41.

*Lumbricillus lineatus* (O. F. Müller, 1774).

Several specimens from black, sandy mud near high water neap.

SITE : Pyrénées, 63.

*Lumbricillus semifuscus* (Claparède) Stephenson, 1911.

Abundant in *Enteromorpha* above high water mark.

SITE : Pyrénées, 62.

*Marionina achaeta* Lasserre, 1964.

In sand dunes.

SITE : Landes, 22, 25, 26, 39.

*Marionina appendiculata* Nielsen and Christensen, 1959.

Wet areas of salt marsh and intertidal algae. Individuals from algal turf (sites 60, 61) differ in several respects from the author's description. The sperm funnel is large, up to 4 times longer than wide and approximately equal to the width of the body with a narrow collar and a seminal vesicle is well developed. Lymphocytes in some individuals are dense as in *M. argentea*, and the blood is distinctly red. Segment number, setal shape and number, penial glands and spermatheca are as in the typical *M. appendiculata*.

This may be a separate species with different ecological requirements. Danish specimens were from coarse sand and grass roots near the water.

SITES : Landes, 28, 29 ; Pyrénées, 60, 61.

*Marionina argentea* (Michaelsen, 1889).

Two small ectal glands are present in some specimens. These have also been reported



in specimens from Germany (MÖLLER, 1970). A common and widespread species in moist-wet soils.

SITES : Landes, 7, 8, 10, 12, 16, 17, 20, 21, 32, 39 ; Libourne, 41, 45, 46, 47, 48, 49 ; Pyrénées, 51, 53, 54, 55, 56, 57 ; Dordogne, 71, 75, 78, 79, 81.

*Marionina clavata* Nielsen and Christensen, 1961.

In forest soil and wet heath.

SITES : Landes, 2, 4, 30, 33, 34, 39 ; Pyrénées, 50.

*Marionina fliformis* Nielsen and Christensen, 1959.

Occasionally 3 setae in some ventral bundles. In wet, acid peat.

SITES : Landes, 9, 10, 20, 21, 32, 34.

*Marionina riparia* Bretscher, 1899 augm. ČERNOSVITOV, 1928.

One record in wet, clay soil.

SITE : Libourne, 49.

*Marionina simillina* Nielsen and Christensen, 1959.

Five specimens in mountain pasture.

SITE : Pyrénées, 57.

*Marionina southerni* (Černosvitov, 1937).

In sand above high water mark.

SITES : Landes, 22, 24.

*Marionina spicula* (Leuckart, 1847).

Most individuals have 3-4 setae per bundle but at one site (23) specimens had only 2 setae in all bundles. In sand at and above high water mark.

SITES : Landes, 23, 27, 38 ; Pyrénées, 64.

*Marionina subterranea* (Knöllner, 1935).

In young sand dunes.

SITES : Landes, 22, 25.

## DISCUSSION

The number of enchytraeid species recorded for France is now 73. The only countries for which more species are known are Denmark (88 spp.) (NIELSEN and CHRISTENSEN, 1959, 1961, 1963), where the family has received most attention, and Ireland (80 spp.) (SOUTHERN, 1909, 1913 ; HEALY, 1975, 1976). The length of national lists probably reflects the intensity of collecting and the type of soils sampled rather than faunal richness. The success of the French survey is believed to be due to the selection of a wide range of soil

types, in particular the inclusion of many marshy habitats which often show high diversity and which appear to have been ignored by many workers elsewhere. A further contribution to the length of the French list is made by the meiofaunal species described by LASSERRE (1964, 1966, 1967, 1968) from deposits on the Atlantic coast, the only area in Europe where such detailed studies have been undertaken. A check list of French enchytraeids is given in table 3.

TABLE 3. — Check lists of french and spanish Enchytraeidae.

SPECIES	FRANCE		SPAIN	
	Previous records	Present survey	Previous records	Present survey
<i>Mesenchytraeus armatus</i> (Levins.)	G	+	—	—
<i>M. beumeri</i> (Mich.)	—	+	—	—
<i>M. gaudens</i> Cognetti	—	+	—	—
<i>M. glandulosus</i> (Levins.)	—	+	—	—
<i>M. pelicensis</i> N. & C.	C	—	—	—
<i>M. sanguineus</i> N. & C.	—	+	—	+
<i>Cernosvitoviella atrata</i> Bretsch.	J, G	+	—	—
<i>C. goodhui</i> Healy	—	+	—	—
<i>C. inmota</i> (Knöllner)	L	—	—	—
<i>C. palustris</i> Healy	—	+	—	+
<i>Cognettia cognettii</i> (Issel)	—	+	—	+
<i>C. glandulosa</i> (Mich.)	J, G	+	—	+
<i>C. hibernica</i> Healy	—	+	—	—
<i>C. sphagnetorum</i> (Vejd.)	—	+	—	+
<i>Hemienchytraeus bifurcatus</i> N. & C.	—	+	—	—
<i>Achaeta aberrans</i> N. & C.	—	+	—	—
<i>A. affinis</i> agg.	—	+	—	+
<i>A. bohémica</i> (Vejd.) : N. & C.	—	+	—	—
<i>A. eiseni</i> agg.	—	+	—	—
<i>A. littoralis</i> Lasserre	L	+	—	—
<i>A. vesiculata</i> N. & C.	—	+	—	—
<i>Enchytronia parva</i> N. & C.	—	+	—	—
<i>Guaranidrilus europeus</i> Healy	—	+	—	+
<i>Henlea nasuta</i> (Eisen)	C	—	—	—
<i>H. perpusilla</i> Friend	—	+	—	+
<i>H. similis</i> N. & C.	—	+	—	—
<i>H. ventriculosa</i> (Udekem)	L	+	—	—
<i>Buchholzia appendiculata</i> (Buch.)	T	—	—	—
<i>B. fallax</i> Mich.	—	+	—	+
<i>Bryodrilus ehlersi</i> Ude	C	+	—	—
<i>Hemifridericia parva</i> N. & C.	—	+	—	—
<i>Fridericia aurita</i> Issel	M	+	—	—
<i>F. bisetosa</i> (Levins.)	C	+	—	+
<i>F. bulboides</i> N. & C.	—	+	—	+
<i>F. bulbosa</i> (Rosa)	—	+	—	—
<i>F. callosa</i> (Eisen)	—	+	—	—
<i>F. caprensis</i> Bell	—	+	N, C	—
<i>F. connata</i> Bretscher	—	+	—	+

SPECIES	FRANCE		SPAIN	
	Previous records	Present survey	Previous records	Present survey
<i>F. discifera</i> Healy	—	+	—	—
<i>F. galba</i> (Hoffmeist.)	N, C, T	+	N, C	—
<i>F. leydigi</i> (Vejd.)	—	+	—	—
<i>F. magna</i> Friend	—	+	—	—
<i>F. paroniana</i> Issel	—	+	—	+
<i>F. perrieri</i> (Vejd.)	—	+	—	+
<i>F. polychaeta</i> Bretsch. : South.	—	+	—	—
<i>F. ratzeli</i> (Eisen)	—	+	N, C	—
<i>F. stephensoni</i> Moszyński	—	+	—	—
<i>F. striata</i> (Levins.)	—	+	—	—
<i>Enchytraeus albidus</i> Henle	L	+	N, C	—
<i>E. buchholzi</i> Vejd.	C, J, M	+	N, C	—
<i>E. bulbosus</i> N. & C.	—	—	N, C	—
<i>E. capitatus</i> v. Bülow	L	+	N, C	—
<i>E. minutus</i> N. & C.	—	+	—	+
<i>Lumbricillus bulowi</i> N. & C.	L	—	—	—
<i>L. kaloensis</i> N. & C.	—	+	—	—
<i>L. lineatus</i> O. F. Müller	L	+	—	—
<i>L. rivalis</i> Levins.	L	—	—	—
<i>L. semifuscus</i> (Clap.)	L	+	—	—
<i>L. viridis</i> Levins.	L	—	—	—
<i>Marionina achaeta</i> Lasserre	L	+	—	—
<i>M. appendiculata</i> N. & C.	—	+	—	+
<i>M. argentea</i> (Mich.)	L, C, J	+	—	—
<i>M. clavata</i> N. & C.	—	+	—	—
<i>M. elongata</i> Lasserre	L	—	—	—
<i>M. filiformis</i> N. & C.	—	+	—	—
<i>M. mesopsamma</i> Lasserre	L	—	—	—
<i>M. preclitellochaeta</i> N. & C.	L	—	—	—
<i>M. riparia</i> Bretscher	J, A, J	+	—	—
<i>M. simillina</i> N. & C.	—	—	—	+
<i>M. southerni</i> (Černosv.)	L	+	—	—
<i>M. spicula</i> (Leuckart)	L	+	—	—
<i>M. subterranea</i> (Knölln.)	L	+	—	—
<i>M. weilli</i> Lasserre	L	—	—	—
<i>Grania roscoffensis</i> Lasserre	E, L	—	—	—
<i>G. postclitellochaeta</i> (Knölln.)	L	—	—	—
TOTAL SPECIES	33	60	7	17

A, J : AMOROS and JUGET (1970). — C : ČERNOSVITOV (1931) (*Enchytraeus buchholzi*); (1936) (*Mesenchytraeus pelicensis*, *Bryodrilus ehlersi*, *Henlea nasuta*); (1941) (*Bryodrilus ehlersi*, *Fridericia galba*, *F. bisetosa*, *Enchytraeus buchholzi*, *Marionina argentea*). — E, L : ERSÉUS and LASSERRE (1976). — G : GIANI (1976). — J : JUGET (1967). — J, G : JUGET and GIANI (1974). — L : LASSERRE (1966) (*Enchytraeus albidus*, *Lumbricillus bulowi*, *L. lineatus*, *Marionina achaeta*, *M. elongata*, *M. mesopsamma*, *M. spicula*, *M. subterranea*, *M. weilli*, *Grania postclitellochaeta*); (1967) (*E. albidus*, *E. capitatus*, *Lumbricillus bulowi*, *L. lineatus*, *L. rivalis*, *L. semifuscus*, *L. viridis*, *Marionina argentea*, *M. achaeta*, *M. elongata*, *M. preclitellochaeta*, *M. spicula*, *M. subterranea*, *M. weilli*); (1968) (*Achaeta littoralis*); (1971) (*Henlea ventriculosa*). — M : MOSZYŃSKI (1938). — N, C : NIELSEN and CHRISTENSEN (1959) (*Fridericia galba*; (1963) Spanish records). — T : TÉTRY (1938).

The only published records of Spanish enchytraeids are those of NIELSEN and CHRISTENSEN (1963) who list 7 species. The Spanish fauna is thus practically unknown. Since only a few locations in Spain were sampled during the present survey, the check list of 24 species (table 3) must be considered as representing only a fraction of the total fauna. One species, *Marionina simillina*, has not been recorded from France.

It is not possible on the basis of two short surveys to obtain more than a superficial view of the local fauna. Nevertheless one can make some estimation of the relative importance of the species from table 2. *Cognettia sphagnetorum* (38 % of sites), *Enchytraeus minutus* (33.2 % of sites), *Marionina argentea* (33.2 % of sites) and *Buchholzia fallax* (27 % of sites) are obviously common and widespread although *M. argentea* was surprisingly absent from the wet soils of La Brière. It is interesting to note that *E. minutus* appears to replace *E. buchholzi* which is one of the commonest enchytraeid species in most European countries investigated. It is difficult to comment on the status of the genus *Achaeta* because so many specimens remain unidentified but the impression gained is that both individuals and species are better represented than in Ireland. Only one species, *A. bohemica*, has been recorded from Fennoscandia and it would seem therefore that the genus is better adapted to warmer climates.

The fauna is essentially the same as that of other countries in western Europe. The only species which, according to present knowledge, may be described as "southern" are *Fridericia caprensis* (Italy, Spain, Romania) and *Guaranidrilus europæus* (a genus previously known only from the tropics). Several species are absent from Denmark and Fennoscandia but appear to be widespread in central Europe, e. g. *Cognettia cognettii*, *Fridericia aurita* and *F. magna*. Five species are, outside France, known only from Ireland: *Cernosvitoviella goodhui*, *C. palustris*, *Cognettia hibernica*, *Achaeta littoralis*, *Fridericia discifera* (Healy, 1976). These may represent a western element but it is possible that suitable habitats have not been studied in other regions. Absentees from western France include some species which are common in most other countries investigated: *Henlea nasuta*, *Fridericia hegemon*, *Lumbricillus pagenstecheri* and *Marionina communis*.

#### NOTE ON THE EFFECTS OF HEAT AND DROUGHT

Despite the long period of drought and the high temperatures (up to 38°C) which prevailed during the 1975 survey period, few soils were entirely barren. The number of enchytraeids extracted from compact grassland soils was small but forest soils which have a loose open structure often yielded high numbers. The presence in these soils of other invertebrates such as Collembola which are notoriously sensitive to low RH, suggests that the dryness may be apparent rather than real.

As a result of investigations in Danish soils, NIELSEN (1955) concluded that enchytraeid activity is excluded by a  $pF \geq 4$  and that entire populations are killed by extended periods of drought. No  $pF$  measurements were made during the present survey but it seems unlikely that a soil which runs through the fingers and which is difficult to wet could have a  $pF < 4$ . NIELSEN also pointed out that enchytraeids are quickly killed by extraction temperatures greater than 25°-30°C. There may be other factors contributing to the survival of individuals in certain soils, e. g. the proportion of colloidal clay and humus,

the volume of pore space and the density of vegetation, but it appears that low soil humidity and high temperature do not have the drastic effects on enchytraeid populations of SW France which have been demonstrated in Denmark. It is suggested that species may be represented by physiological races which are adapted to local climatic conditions.

The high proportion of sexually mature individuals is a further indication of climatic adaptation. In a coniferous forest in N. Wales, practically no mature individuals were present in July and only 12 % of the total population were mature in August (O'CONNOR, 1959). REYNOLDSON (1947) also reported a minimum of adults (13 %) in July in sewage beds in Wales. With the exception of *Cernosvitoviella* spp. no difficulty was experienced in finding mature individuals during the summer survey. For most species, mature specimens far outnumbered immature and juveniles were rare.

In October 1977, most soils had a higher water content than at the previous sampling but samples were too small to allow a satisfactory comparison of faunal content at the same site on the two occasions. In general there seems to have been an increase in diversity which may reflect a differential mortality prior to sampling in the summer of 1975. The mean number of species per site in the Landes region increased from 4.58 in summer 1975 to 5.0 in autumn 1977. In particular the drier soils which were dominated by *Achaeta* species in 1975 e. g. sites 1, 13, 18, had a more diverse fauna when resampled.

It is generally believed that enchytraeids are characteristic of cold or temperate climates. Tropical regions certainly appear to be poor in species judging by the records and comments of ČERNOSVITOV (1937) and MICHAELSEN (numerous publications). In western Europe, both taxonomic and ecological investigations have mostly centred in northern countries. Only a few collections have been made in southern regions, mainly from aquatic habitats (lakes, rivers and the marine littoral) or from mountainous areas. This has perhaps given a false impression of enchytraeid distribution in Europe. The results of the present survey indicate that the fauna of SW France is no less rich in species than that of Ireland or Denmark although population densities may be lower, particularly in coniferous humus layers.

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*ADDENDUM* : *Cernosvitoviella palustris* Healy is probably identical with *C. estaragniensis* Giani which appeared in *Annls Limnol.*, **15** (2) : 110-112 (1979).

